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Market Discipline and Bank Charter Value: The Case of Two Safe Banking Industries

Mamiza Haq[a*], Amine Tarazi[b], Necmi Avkiran[c], Ana Rosa Fonseca[d]

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Abstract

This paper analyses the relationship between market discipline and bank charter value using a panel dataset of publicly-listed domestic banks in Australia and Canada over the 1995–2011 periods, with particular focus on the 2007/2008 global financial crisis (GFC). Overall, our results show a positive relationship between market discipline and bank charter value, although this has reduced in the post-GFC period. Furthermore, our findings reveal that in the presence of market discipline, bank capital, contingent liabilities, and non-interest income are important sources of charter value. These findings have important policy implications related to bank safety and soundness. The results are robust to model specification.

JEL: *G21, G32*
Key words: charter value, market discipline, global financial crisis.

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1. Introduction

This study investigates the relationship between market discipline and bank charter value[1] for publicly listed domestic banks in Australia and Canada during the 1995-2011 periods. We particularly examine whether the link between these factors is impacted by specific characteristics such as regulatory capital strength, exposure to contingent liabilities and non-traditional intermediation activities. We question whether such bank-specific characteristics affect bank charter value particularly in the presence of market discipline. Specifically, we explore this issue during the 2007/2008 global financial crisis (GFC).

We evaluate the unique settings of Australian and Canadian banks because they demonstrated extra-ordinary resilience during the global credit turmoil that started in mid-2007. Australia and Canada share an important feature: these countries' banks have avoided being identified as among the world's systemically important banks, a status that would have carried additional regulatory scrutiny. Despite the GFC, Australian and Canadian banks continue to be profitable and well-capitalized. Attributes that helped the financial systems of these countries to weather the storm include well-regulated mortgage markets, strong domestic deposit bases to support lending, less reliance on foreign liabilities, limited shadow banking sectors, prohibition of mergers among major domestic or foreign banks, and active and sound supervisory regimes with close co-operation among authorities (International Monetary Fund, 2013). Further, the Basel III framework incorporates many of the advantages of the Canadian banking system, including the leverage ratio and substantially higher quantity, quality and transparency of Tier 1 capital, among others.

Banks have incentives to take 'excessive' risk at the expense of tax-payers funds and creditors because of the well-known 'moral hazard' problem emanating from limited liability and mispriced deposit insurance premium (Merton, 1977). This is compounded by the 'too-big-to-

[1] Risk-taking incentives of banks depend on their values charter, which reflect future economic rents that banks obtain from privileged access to markets protected from competition (Goyal, 2005). Banks thus have fewer incentives to engage in risk taking activities, because if they fail, they lose their valuable charters (Keeley, 1990).

fail' effect with large banks. Risk-taking incentives are however tempered if banks have something to lose in case of failure, such as their franchise or charter value (Demsetz, Saidenberg and Strahan, 1996). The disciplining role of the charter value was first pointed out by Marcus (1984), who argues that increased competition in the bank industry erodes banks' charter values, thus increasing incentives for excessive risk-taking. Similarly, Keeley (1990) has shown that in the pre-deregulation era (prior to the 1980s) the fear of losing their franchise (entry barriers in banking) compensated for banks' risk-taking incentives due to underpriced deposit insurance.

In recent years, with higher competition in banking and consequently a lower disciplinary role for charter value, considerable attention has been paid to market discipline. Market discipline is defined as a market-based mechanism in which investors in bank liabilities such as uninsured depositors penalize banks for taking excessive risk by requiring higher interest rates or withdrawing their deposits (Martinez-Peria and Schmukler, 2001). These market-based disciplinary tools can thus make it more costly for banks to take risk. Banking reform proposals that encourage the provision of private efforts[2] in monitoring and controlling bank risk are therefore considered to be more effective than direct regulatory oversight (Goyal, 2005).

The Basel Committee on banking supervision emphasizes market discipline as one of the three pillars of bank regulation. Pillar 3 recognizes that market discipline has the potential to reinforce minimum capital standards (Pillar 1) as well as the supervisory review process (Pillar 2), and hence to promote the safety and soundness of banks.

Deposit insurance matters in this context, in that if deposits are not completely insured, depositors may demand higher returns for higher risk, since higher risk-taking increases the likelihood of financial distress. Thus, we can hypothesize that, if uninsured depositors impose market discipline, bank funding costs should be reduced, with a positive influence in turn on bank charter value. In effect, stronger market discipline for such banks can be of benefit in terms of avoiding loss of charter value.

[2] For example, mandated issuance of subordinated debt which provides direct discipline if subordinated debt yields are positively associated with risk (Goyal, 2005).

Our approach in this paper complements the existing literature on the determinants of charter value (González, 2005; Saunders and Wilson, 2001). Previous papers have analyzed the relationship between bank charter value and bank risk but do not provide a comprehensive analysis of market discipline as a key determinant of charter value. By contrast, our approach is to analyse the impact of market discipline on charter value, controlling for risk and general economic conditions, using Australian and Canadian banks as a less noisy panel dataset.

Our study contributes to the existing banking literature in several important ways. First, this is one of the few studies that investigate the possibility of complex associations that might exist between the determinants of charter value. For example, we explore the influence of capital requirements on market discipline and the way this affects charter value. Another feature of this study is the analysis of the influence of contingent liabilities, profitability and non-traditional intermediation activities on market discipline in increasing bank charter value. Second, the body of literature on bank charter value and market discipline is limited to US and Europe, and practically non-existent for Australia and Canada. Finally, this study closely examines the corrective effect of market discipline, bank capital, and other bank-specific characteristics on bank charter value during the GFC period. Thus, this provides an opportunity to investigate the differential crisis-effect of various factors on charter value.

We analyse individual listed banks from Australia and Canada, which account for around 88% of Australian and 90% of Canadian banking system assets respectively. The time period, 1995–2011 covers a period of extensive and rapid regulatory changes for both countries' financial sectors.[3] Our results suggest that, on average, market discipline increases bank charter value, although its influence varies depending on other bank characteristics (including bank

[3] For example, for Australian banks, we observed five important financial milestones: the establishment of the Australian Prudential Regulation Authority (APRA) in 1998; the commencement of "Financial Services Reform Act 2001" in 2002; changes to prudential regulation resulting from Basel II being introduced progressively from 2007; introduction of explicit deposit insurance scheme following the GFC 2007/2008; and the formation of Financial Stability Board (FSB) in April 2009 (as the re-establishment of the Financial Stability Forum (FSF), which had existed since 1999). Similarly, in the past two decades, legislative restructuring has led to structural changes in the Canadian banking system. Since the 1992 and 1997 Bank Act amendments, the banks shifted towards off-balance sheet activities and fee income. Further, following the GFC, Canada announced its intention to fully implement Basel III requirements on all Canadian banks by 2013.

capital, contingent liabilities and fee income) and the GFC. Most specifically, we find that interbank deposits impact charter value when banks have higher bank capital. Our findings also indicate that depositors and creditors consider fee-based income to be risky, thus reducing bank charter value. Most notably, we find that sensitivity of charter value to market discipline is reduced in the post-GFC period. Finally, banks with higher profitability tend to benefit from higher charter value in the post-GFC period.

The remainder of the paper is structured as follows. Section 2 discusses the relevant literature and research focus that underlie the paper's analysis. Section 3 presents data and methodology. Section 4 describes the empirical analysis while robustness checks are provided in Section 5. Finally, Section 6 concludes the paper with some policy implications.

2. Literature review and research focus

2.1 Market discipline - deposit growth

There is mixed evidence in the banking literature on depositor discipline and bank risk-taking. Prior studies (e.g., Demirgüc-Kunt and Huizinga, 2004; Martínez-Peria et al., 2001; Park and Peristiani, 1998) conclude that depositors punish riskier banks by withdrawing their money and/or demanding higher interest rates. However, when associated with deposit insurance/government guarantees, market discipline fails to discipline bank risk-taking (Demirgüc-Kunt et al., 2004). Martínez-Peria et al. (2001) thus argue that when deposit insurance is not credible, market discipline may exist. Further, Fonseca and González (2010) demonstrate that if a bank has market power in the deposit market, it may have a lower incentive to increase costly bank capital to reduce the cost of deposits when its risk profile increases.

2.2 Market discipline – subordinated debt

The market disciplinary role of subordinated debt is evident as banks move into riskier activities. It has been argued that subordinated debt directly affects bank risk from the higher funding costs that riskier banks face, through derived discipline, and finally from the tax benefits of debt (Evanoff and Wall, 2002). These benefits include providing a signal of bank riskiness or

asset quality to market regulators and investors. Based on the signal, the banks can lower their cost of funding and/or increase their capital requirements.

Rational subordinated debt holders require a higher premium from riskier banks as compensation for the higher risk they bear. This, in turn, means market prices and interest rates should reflect individual bank riskiness. Subordinated debt prices can have both direct and indirect disciplinary effects on bank behaviour (Flannery, 2001). Direct market discipline exists when the probability of default causes the risk premium demanded by potential subordinated debt holders to increase. This raises banks' cost of funding and consequently incentivises them to pre-emptively limit excessive risk-taking. Indirect market discipline occurs when an increase in bank's probability of default reduces the secondary market price for subordinated debt. These price movements signal a bank's solvency status. Thus, regulators and market participant can use this information to examine bank's activities. Indeed, banks can avoid this burden by pre-emptively lowering risk (Flannery, 2001).

Furthermore, Flannery and Sorescu (1996) argue that both asset quality and market leverage impact subordinated debt while there is little evidence of a relationship between interest rate risk and subordinated debt. However, these arguments should be judged with some caution with Calem and Rob (1999) showing that subordinated debt may have little impact on the portfolio allocation decision of a well-capitalized bank. Blum (2002) argues that, if a bank is committed to a level of risk, the presence of subordinated debt can help to reduce bank risk but, if the bank is not committed to a specific level of risk, the issue of subordinated debt may flag higher risk than under a full deposit insurance regime.

2.3 Market discipline – interbank deposits

There is some empirical evidence on the market disciplinary effect of uninsured deposits including subordinate debt and interbank deposits[4]. For example, Nier and Baumann (2006) find that subordinated debt investors in European and US banking, excluding government owned or

[4] Interbank deposits involve unsecured lending between financial institutions. Typically, these deposits are not covered by an explicit deposit insurance scheme. It is often argued that banks are likely to be informed investors in the inter-bank market.

guaranteed institutions, are sensitive to bank risk. Nier et al. (2006) use a number of market discipline variables including uninsured liabilities. Their study finds that uninsured liabilities are positively related to bank capital ratios, creating an incentive for banks to limit their risk of insolvency by choosing a higher capital buffer for a given level of risk.

Further, Rochet et al. (1996) support the idea that regulators can use market signals to identify banks that the market perceives as risky. They argue that interbank exposures can contribute to prudent market behavior and reduce the probability of bank failure and systemic distress. This can be achieved by creating incentives for lending banks to monitor interbank borrowing banks. In essence, lending banks perform a complementary task to bank regulators and supervisors (Dinger and Von Hagen, 2009). However, in an environment where interbank borrowers are large, this disciplining role of interbank borrowing may be hindered by "too-big–to-fail" concerns, since interbank lenders may anticipate potential bail-outs of large interbank borrowers (Rochet et al., 1996). This concern led to a number of studies (e.g., Distinguin, Kouassi and Tarazi, 2012; Dinger et al., 2009) investigating small (borrowing) institutions and countries (in particular, Central and Eastern Europe) with long-term interbank lending (as opposed to short-term/overnight loans observed in developed markets such as the USA). The findings confirm that interbank borrowing is associated with substantially lower risk-taking by borrowing banks and is thus consistent with monitoring performed by the lending banks.

2.4 Bank capital

The relationship between bank charter value and bank capital has been discussed extensively (Keeley, 1990). This association can be explained by a moral hazard effect and a market rent effect (Allen and Rai, 1996). It is well-known that government guarantees or safety nets (such as deposit insurance, too-big-to-fail guarantees, and lender of last resort) can lead to a moral hazard problem. If the value of guarantees to the bank is less than they are charged for them, the safety net provides banks with a net subsidy (Allen et al., 1996), which is incorporated within the bank's charter value. Thus, the moral hazard effect explains that, if bank charter value

stems from government subsidies, this may discourage banks from holding capital. As these subsidies become more generous, bank capital is substituted by a government safety net and a negative association emerges between charter value and bank capital.

The market rent effect, however, reflects a positive association between bank capital and charter value. To avoid any additional costs from providing a subsidy, governments impose restrictions on entry to banking. Entry restrictions allow banks to earn monopoly rents that may be dependent on the terms of the safety nets. Imperfectly competitive financial markets can also allow banks to earn monopoly rents and thus, higher charter value. Bank failure can force the shareholders to surrender the bank's charter value or expected profits from continued operations. Therefore, banks' expected future profitability leads to higher charter values which, in turn, reflect greater capital buffer which may be significant for shareholders to retain control and reduce the probability of default. In our sample banks we find that banks maintain a much higher capital buffer than the regulatory requirement of the Basel Accords I and II. We are also cognizant of evidence from the GFC that Australian and Canadian banks appear to have pursued safer policies, thus preserving financial stability.

Bank regulators' use of capital regulation to control bank risk can bring the desired outcome if supplemented by other supervisory tools such as market discipline (via subordinated debt). Herring (2004) argues risk-weights fail to reflect risk accurately, encouraging banks to implement procedures that do not account for portfolio diversification, and Basel II imposes heavy compliance costs and makes it hard to monitor the enforcement of capital requirements. Market discipline via subordinated debt can enhance the effectiveness of capital regulation at a much lower cost. For example, market discipline discourages regulatory arbitrage because subordinated debt holders are more concerned about the bank's overall exposure to the risk of insolvency than the regulatory risk weights. In addition, banks can benefit from quantifying and controlling their overall exposure to risk. Thus, market discipline can complement the functions of bank capital. From a banker's viewpoint, issuing subordinated debt may substitute

conveniently for direct recapitalization through equity issues, which can entail substantial agency costs under information asymmetry (Myers and Majluf, 1984) and can increase the probability of failure (Ashcraft, 2008).

2.5 Other variables of interest

The other variables of interest in our analysis include revenue diversification, contingent liabilities and profitability[5]. Several studies (Tan and Floros, 2013, Lepetit, Nys, Rous and Tarazi, 2008; Stiroh and Rumble, 2006) suggest that banks' expansion into non-traditional financial activities is not associated with diversification benefits, but rather with lower risk-adjusted return (or charter value) and higher insolvency risk. However, Baele, De Jonghe and Vennet (2007) provide evidence that the market judges more diversified banks to have a higher return potential (measured by Tobin's Q). Williams (2012) finds evidence in the Australian context that combining interest with non-interest revenues does not generate any portfolio diversification benefit, supporting the argument that greater complexity can lead to an increase in agency costs that may exceed any diversification benefits (Schmid and Walter, 2009; Laeven and Levine, 2007).

Contingent liabilities can help banks to earn rents temporarily if they have superior production technology that may not be available to other institutions, the so-called first-mover effect (Furlong and Kwan, 2006). Banks may have scope economies with other bank activities giving them a cost-advantage over non-bank institutions because banks have a comparative advantage in off-balance sheet activities like loan commitments (Haq and Heaney, 2012). Hence, the combination of scope economies and potential efficiency enhancement can contribute to improve banks' charter value (Furlong et al., 2006).

In summary, our paper extends earlier studies in several directions. First, we consider that uninsured liabilities such as subordinated debt and interbank deposits are effective in

[5] Contingent liabilities include the bank guarantees attached to commercial letters of credit, loan commitments and stand-by letters of credit. It helps banks, particularly in times of increased competition, to expand their revenue sources without altering their capital structure.

providing incentives for banks to limit their risk-taking and maintain a higher charter value. Indeed, we argue that as the bank's risk profile increases the depositors will demand higher returns, so that banks will have an incentive to maintain higher bank capital which, in turn, will increase bank charter value. Second, regulators have tried to counter-balance incentives by giving capital adequacy a more prominent role in the prudential regulatory process.[6] Thus, it is crucial to ascertain the relation between bank charter value and subordinated debt to understand whether subordinated debt can be treated as a substitute for bank capital. Third, in our analysis we predict that revenue diversification increases bank charter value. This is a plausible prediction since our sample countries have, on average, less volatile non-interest income, unlike their peers such as US banks where diversification effects may be dominated by volatility effects (Reserve Bank of Australia, 2012, Stiroh, 2006). Finally, we explicitly explore the impact of the determinants of bank charter value in the presence of market discipline and during 2007/2008 crisis.

3. Data and Methodology

3.1 Data

The dataset is of listed banks in Australia and Canada. Bank level information, including the balance sheet and income statement are extracted from both Bankscope and Osiris databases. Market information including market value of equity is collected from Datastream International. The sample involves all publicly listed banks observed over 1995 to 2011, giving an unbalanced panel of 282 bank-year observations. Following recent mergers, the four largest Australian banks account for around 88% of the Australian banking system assets while the six largest Canadian banks account for around 90% of the Canadian banking system assets. The list of banks is shown in Table 1

[Insert Table 1 about here]

[6] For instance, Tier 1 capital requirements, which include common equity and other qualifying financial instruments based on stricter criteria, will increase from 4% to 6% in Basel III.

3.2 Dependent variable

The dependent variable, bank charter value, can be measured by *Tobin's Q,* defined as the ratio of the sum of the market value of equity and the book value of liabilities to the book value of total assets (Keeley, 1990). Charter value reflects market capitalization, and thus the current and future business environment that a bank operates in.

$$\text{Charter value}_{i,j,t} = \frac{\text{Market value of Equity}_{i,j,t} + \text{Book value of Liabilities}_{i,j,t}}{\text{Book value of Assets}_{i,j,t}} \quad (1)$$

with subscripts i, j,t represents an individual bank i in country j at time t (i.e. 1995-2011).

An alternative proxy for bank charter value is the ratio of demand deposits to total deposits (Goyal, 2005).

$$\text{Demand deposit ratio}_{i,j,t} = \frac{\text{Demand deposits}_{i,j,t}}{\text{Total deposits}_{i,j,t}} \quad (2)$$

The subscripts i, j,t represents an individual bank i in country j at time t (i.e. 1995-2011). This ratio is a measure of market power in the deposit market. Keeley (1990) argues that a bank's ability to issue deposits below the market rate is an important component of bank charter value. Consistent with this argument, Neumark and Sharpe (1992) raise two concerns: first, banks with market power are slow to adjust their deposit rates upward in response to rising open market rates; and second, those same banks adjust their deposit rates downward in response to falling market interest rates more rapidly.Hutchinson and Pennacchi (1996) show that many banks exercise their market power in setting retail deposit rates, with demand deposits contributing significantly to a bank's charter value. We therefore use the demand deposits ratio as an alternate proxy for charter value.

3.3 Explanatory variables

This study explores market discipline as a potential determinant of bank charter value. As discussed in Section 2, we propose alternative proxies for market discipline including *deposit growth, subordinated debt*, *and interbank deposits*. Deposit growth is the ratio of change in deposit and

short term funding to the gross domestic product (GDP) deflator (Demirguc-Kunt et al., 2004). Subordinated debt is measured by total subordinated debt to total liabilities, and finally, interbank deposit is the ratio of total interbank deposits to total liabilities (Nier et al., 2006).

Bank capital (*Tier 1*) is measured by common equity relative to risk-adjusted assets. Contingent liabilities (*CL*) are measured by total off-balance sheet items against total liabilities. Off-balance sheet items or contingent liabilities include managed securitized assets, guarantees, acceptances and documentary credits, and committed credit lines and other contingent liabilities. Revenue diversity is captured by non-interest income (*NII*), calculated as net fees and commission against total operating income for individual banks. Bank profitability is measured by the return on average equity (*ROAE*). Finally, we incorporate bank size (*SZ*) and bank size squared (SZ^2) (natural logarithm of total asset) to capture any effects of size differences among the sample banks.

A number of additional country-level factors could also be important to bank charter value such as the degree of bank concentration and real GDP growth rate (*RGDP*). Bank concentration ratio (*BKCON*) is included to control for cross-country variation in the structure of the banking sector (Beck, Demirgüç-Kunt and Levine, 2010). Bank concentration can show a positive or a negative relationship with bank risk, depending on the intensity of bank competition. Theoretically, from a bank risk perspective, higher competition may have a harmful impact on financial system stability ("too big to fail" problem) if it leads to erosion of charter value and encourages greater risk (Boyd, De Nicoló and Al Jalal, 2006). In contrast, Beck, Demirguc Kunt and Levine (2006) find that a more concentrated banking system is subject to a lower probability of systemic risk and is thus more stable.

We follow Demirgüç-Kunt et al. (2004) and incorporate real GDP growth (*RGDP*) as the macro-economic control variable. This will capture the impact of macro-economic shocks that adversely affect bank performance by increasing risk. We predict the relationship to be positive

with charter value. Finally, we include crisis dummy *(Crisis)* which equals 1 for period 2008-2011 and 0 otherwise. Table 2 below summarizes our dependent and explanatory variables.

[Insert Table 2 about here]

3.4 Descriptive statistics and correlation analysis

Table 3 presents the descriptive statistics for bank characteristics and macro-economic variables. Keeley's measure of charter value has a mean of 1.03, while Goyal's measure of charter value has a mean of 0.538. We observe that Australian banks have maintained higher charter values compared to their Canadian counterparts, with a peak observed after 1997.[7] The Wallis Inquiry, which reported in 1997, may have created an appropriate balance between achieving competitive outcomes and ensuring financial safety and market integrity (Wallis, Beerworth, Carmichael, Harper and Nicholls, 1997).

The alternative measures of market discipline, that is, *deposit growth, subordinated debt*, *and interbank deposit* ratios have mean values of 0.001, 1.116, and 0.045 respectively. The Australian banking system has a wholesale funding (includes interbank deposits) ratio of 34%, higher than for the Canadian system at 23% (Reserve Bank of Australia, 2012). We use interbank lending because interbank markets are not the same because of differences in central bank procedures and overnight cash markets. A higher wholesale ratio does not necessarily indicate higher funding risk since the maturity and diversity of wholesale funding may differ, with some wholesale funding, for example, being long-term.

In addition, our data suggests that interbank deposits relative to total liabilities slumped to a low of 3% in 2011 for Australia. We can also observe that Australian banks' dependence on inter-bank borrowing is greater than their dependence on the subordinated debt market. Further, Australian banks are more active in the subordinated debt market compared to their Canadian counterparts. However, the outstanding amount of Australian banks' subordinated debt has

[7] *Source*: Authors' own calculation.

fallen around $10 billion since September 2008, after strong issuance in the earlier part of the decade.

[Insert Table 3 about here]

In general, banks hold Tier 1 ratio well above the minimum capital requirement of 4%. For example, the maximum Tier 1 ratio 14.7% is observed for Canadian Imperial Bank of Commerce, while the minimum of 6.1% is observed for Bendigo and Adelaide Bank. Regarding size, as of 2011, the smallest bank in the study is Canadian Western Bank with total assets of USD 14,913.23 million, whereas the largest bank, Royal Bank of Canada has total assets of USD 797,261.20 million.

The macroeconomic variable real GDP growth rate (*RGDP*) reflects both crisis and normal periods, and thus the minimum and maximum values capture volatility. Data indicate that in 2009, Canadian GDP growth was -2.77% while Australian GDP growth was 1.37%. The market structure variable bank concentration ratio shows that the share of the top three banks in the industry ranged from 37% to 77%, with a mean value of 53% indicating that Australian and Canadian banks operate in a concentrated and competitive market.

Pearson correlation coefficients are reported in Table 4. The correlation between deposit growth and bank charter value is 0.11 and statistically significant at the 5% level. This indicates market discipline is positively linked to bank charter value. The correlation between size and charter value (Keeley's measure) is 0.26 and statistically significant. Other bank-specific variables are also significantly correlated with charter value including profitability ratio *(ROAE*) (0.45), and off-balance sheet activities (*OBS*) (0.34). To ensure that correlations will not lead to multi-collinearity, we check the variance inflation factors (VIF). All VIF values were less than 10, with the means lying between 2 and 4, suggesting that multi-collinearity is not a serious problem (Gujrati, 2003).

[Insert Table 4 about here]

3.5 Empirical method

To examine the impact of market discipline on bank charter value, we estimate the following panel data model applying both individual bank and time fixed effects:

$$CV_{i,j,t} = \begin{cases} \alpha_0 + \beta_1 MD_{i,j,t} + \beta_2 Tier1_{i,j,t} + +\beta_3 OBS_{i,j,t} + \beta_4 ROAE_{i,j,t} + \beta_5 NII_{i,j,t} + \beta_6 Size_{i,j,t} + \beta_7 Size^2_{i,j,t} + \\ \gamma_1 BKCON_{j,t} + \gamma_2 GDPGr_{j,t} + \delta_1 Crisis_t + \eta_i + \tau_t + \varepsilon_{i,j,t} \end{cases} \quad (3)$$

In addition, to examine how the association between market discipline and charter value is conditional on the strength of a bank's capital regulation, and contingent liabilities, we estimate the following specification:

$$CV_{i,j,t} = \begin{cases} \alpha_0 + \beta_1 MD_{i,j,t} + \beta_2 Tier1_{i,j,t} + \beta_3 OBS_{i,j,t} + \beta_4 ROAE_{i,j,t} + \beta_5 NII_{i,j,t} + \beta_6 Size_{i,j,t} + \beta_7 Size^2_{i,j,t} + \gamma_1 BKCON_{j,t} + \\ \gamma_2 GDPGr_{j,t} + \delta_1 Crisis_t + \delta_2 MD_{i,j,t} \times Tier1_{i,j,t} + \delta_3 MD_{i,j,t} \times OBS_{i,j,t} + \eta_i + \tau_t + \varepsilon_{i,j,t} \end{cases} \quad (4)$$

Equation (5) explores the association between market discipline and charter value conditional on a bank's ability to generate fee income and profitability.

$$CV_{i,j,t} = \begin{cases} \alpha_0 + \beta_1 MD_{i,j,t} + \beta_2 Tier1_{i,j,t} + \beta_3 ROAE_{i,j,t} + \beta_4 OBS_{i,j,t} + \beta_5 NII_{i,j,t} + \beta_6 Size_{i,j,t-1} + \beta_7 Size^2_{i,j,t-1} + \gamma_1 BKCON_{j,t} + \\ \gamma_2 GDPGr_{j,t} + \delta_1 Crisis_t + \delta_3 MD_{i,j,t} \times NII_{i,j,t} + \delta_4 MD_{i,j,t} \times ROAE_{i,j,t} + \eta_i + \tau_t + \varepsilon_{i,j,t} \end{cases} \quad (5)$$

We also develop two more models (equations 6 and 7) which consider crisis as the time dummy variable in investigating the impact of bank regulation and market discipline (equation 6) and bank performance (equation 7) on charter value during the GFC.

$$CV_{i,j,t} = \begin{cases} \alpha_0 + \beta_1 MD_{i,j,t} + \beta_2 Tier1_{i,j,t} + \beta_3 ROAE_{i,j,t-} + \beta_4 OBS_{i,j,t} + \beta_5 NII_{i,j,t} + \beta_9 Size_{i,j,t} + +\beta_{10} Size^2_{i,j,t} + \\ \gamma_1 BKCON_{j,t} + +\gamma_2 GDPGr_{j,t} + \delta_1 Crisis_t + \delta_2 Crisis_t \times MD_{i,j,t} + \delta_3 Crisis_t \times Tier1_{i,j,t} + \eta_i + \tau_t + \varepsilon_{i,j,t} \end{cases} \quad (6)$$

$$CV_{i,j,t} \begin{cases} \alpha_0 + \beta_1 MD_{i,j,t} + \beta_2 Tier1_{i,j,t} + \beta_3 ROAE_{i,j,t} + \beta_4 OBS_{i,j,t} + \beta_5 NII_{i,j,t} + \beta_9 Size_{i,j,t} + +\beta_{10} Size^2_{i,j,t} + \gamma_1 BKCON_{j,t} + \\ \gamma_2 GDPGr_{j,t} + \delta_1 Crisis_t + \delta_2 Crisis_t \times ROAE_{i,j,t} + \delta_3 Crisis_t \times OBS_{i,j,t} + \delta_4 Crisis_t \times NII_{i,j,t} + \eta_i + \tau_t + \varepsilon_{i,j,t} \end{cases} \quad (7)$$

where: i for individual banks (i = 1, 2, , 16); j for country (j = 1, 2), t for time period (t = 1995, 1997, ….., 2011); η_i is the individual fixed effects, τ_t is the time fixed-effects, and ε is the remaining disturbance term. Table 2 provides detailed definitions of the dependent and explanatory variables.

4. Empirical Results

4.1 Main results

Table 5 reports the results of equation (3). These show that the coefficient on deposit growth across alternative measure of charter value is positive and statistically significant at the 5% level or better (*see columns 1, 4*). This result is consistent with the argument that depositors discipline banks when faced with greater risk-taking.

[Insert Table 5 about here]

With regards to the subordinated debt variable (*see columns 2, 5*) in Table 5, we find that a larger proportion of subordinated debt is associated with larger charter value, consistent with the disciplining role of the subordinated debt. This finding is not only statistically but also economically significant. For instance, an increase in subordinated debt by one standard deviation would increase bank charter value by approximately 9%. The finding suggests that a larger share of uninsured funding influences banks to take less risk and, in turn, increase intrinsic value. This further supports the argument that, the larger the amount of uninsured funding, the greater the probability that market discipline will have a greater cost impact (Nier et al*.,* 2006; Gropp, Vesala and Vulpes, 2006). Finally, we do not find a significant relationship between interbank deposits and charter value (*see columns 3 and 6*). One possible explanation can be that our sample banks did not face the same liquidity crisis experienced elsewhere during 2007/2008. With regard to Australian banks, inter-bank liquidity tightened significantly with all banks increasing their holding of Exchange Settlements Account at the Reserve Bank (Reserve Bank of Australia, 2012). Australian banks have lower interbank deposits compared to their Europe and USA counterparts. However, Australian banks are heavily involved in long-term wholesale funding and are required to hold more liquid assets including government debt to deal with liquidity (Reserve Bank of Australia, 2012).

For each of the reported specifications in *columns 1-3*, we find that higher bank capital translates into higher charter value. As can be seen from Table 5, the coefficient of Tier 1 ratio is

positive and statistically significant with alternative market discipline measures indicating the presence of the market rent effect. Thus, if bank charter value arises from market power, then banks will hold higher levels of capital to preserve their access to monopoly rents (Allen et al., 1996). To gain some sense of the economic relevance of the coefficients, we note that an increase in bank capital by one standard deviation would increase bank charter value by approximately 6%. Yet, we do not find any appreciable evidence when we apply Goyal's (2005) measure of bank charter value (*see, columns 4-6).* Therefore, the findings further confirm that a market-based measure of charter value may be important to regulators and supervisors because it infers the true condition of a bank; this measure can thus, influence regulators to act sooner and avoid costly delay (Flannery 2001).

In addition, we find a positive and statistically significant (at the 5% level) association between contingent liabilities and charter value, suggesting that contingent liabilities increase bank charter value for Australian and Canadian banks and these liabilities may not be as risky as perceived. One explanation could be that our sample banks are only moderately involved in contingent liabilities. For example, APRA limits banks' holdings of securitized assets to a maximum of 25% of their loan portfolio. Further, APRA enhances the Basel II framework by including higher risk weights for securitization exposures to better reflect the risk inherent in these products, requirements in relation to valuation practices, and the capture of off-balance sheet and securitization activities, and increased disclosure requirements for securitizations and off-balance sheet exposures. This finding is not only statistically significant but also economically significant. An increase in contingent liabilities by one standard deviation would increase bank charter value by approximately 5% *(see column 3).*

Across all market discipline proxies, with Keeley's (1990) measure of charter value, the coefficient on fee income is positive and statistically significant at the 5% level or better, indicating that the market judges more diversified banks to have a higher return potential (Baele et al., 2007). This means that banks benefit from revenue-based diversification. An increase in

fee income by one standard deviation would increase bank charter value by approximately 10% (*see column 3*). Even though this finding is contrary to Mercieca, Schaeck and Wolfe (2007) on European banks and Stiroh et al. (2006) on US banks, their studies focus on accounting measures of performance. Hence, one possible explanation for the difference may be due to the scope of the sample. The Australian and Canadian banking landscapes differ from the US, whose banks have expanded into activities such as insurance. In addition, Australian and Canadian financial supervisors have a longer tradition of cooperation across different functional areas, which may have eliminated agency costs for the institution as well as the customers. Consequently, in these two countries, investors appear to base their valuation on the potential income of non-traditional revenue sources.

Finally, the greater the return on average equity, the higher the level of bank charter value, suggesting that more profitable banks will find it easier to raise equity through retained earnings; similarly, less profitable banks face the cost of issuing equity that may lead to a lower bank charter value than their peers. The finding is consistent with the work of Fonseca et al. (2010) and Nier et al. (2006).

With regard to the country-level variables, with Keeley's (1990) charter value measure we find that the coefficient of real GDP growth rate is negative and statistically significant (*see columns 1-3*). Since, the economic conditions can affect both the numerator (equity) and the denominator (assets) our findings suggest that charter value may be counter-cyclical, similar to capital buffer (Ayuso, Pérez, and Saurina, 2004). In contrast, using Goyal's (2005) measure, we find a positive and statistically significant association between a bank's intrinsic value and GDP growth (*see columns 4-6*). This finding is consistent with the argument that banks operating in a country with a higher rate of GDP growth extract greater rents from market power in deposit markets (De Jonghe and Vennet, 2008). The coefficients of crisis dummy are negative and statistically significant at the 1% level, indicating that, on average, bank charter value declined after the GFC.

4.2 Intermediating effect of market discipline

We also analyse the impact of bank capital, and contingent liabilities on bank charter value, in the presence of market discipline. We report the results of equation 4 in Table 6. First, we focus on the influence of Tier 1 capital on bank charter value in the presence of market discipline. Our findings show that (with Keeley's measure) the coefficient of interaction between Tier 1 and interbank deposits is positive and statistically significant at a 5% level. This suggests that interbank deposits impact charter value when banks have higher bank capital. However, we do not find any appreciable evidence when we use deposit growth and subordinated debt as a proxy for market discipline (*see columns 1, 2*) with both charter value measures.

[Insert Table 6 about here]

With regard to Keeley's measure, the positive and statistically significant coefficient with alternative measures of market discipline suggest that market discipline impacts on charter value more strongly when banks have more contingent liabilities (*see columns 1, 2*). However, with regard to Goyal's measure of charter value the positive and statistically significant coefficients of *contingent liabilities* × *deposit growth* (*see column 4*) and *contingent liabilities* × *interbank deposits* (*see column 6*), suggest that contingent liabilities increase bank charter value in the presence of market discipline.

In addition, we report the results of equation 5 in Table 7. The positive coefficient on *ROAE* × *market discipline* (*see columns 1-6*), confirms that the impact of return on average equity on bank charter value is more pronounced, in presence of market discipline. Thus, more profitable banks attract more uninsured deposits, increasing bank charter value.

Finally, the coefficient on *non-interest income* × *market discipline* (i.e., deposit growth, subordinated debt and interbank deposits) is negative and statistically significant at a 5% level or better (*see columns 1, 2, 5, 6*). The finding suggests that depositors and creditors consider fee-based income to be risky, which reduces bank charter value. Further, our result supports the argument that non-interest income provides banks with limited diversification (Stiroh, 2006). However,

Lepetit et al. (2008) argue that fee-based income (and not trading income) and risk are positively correlated when they analyse European banks. Diagrammatic presentation of the result is reported in Appendix 1.

[Insert Table 7 about here]

4.3 Impact of GFC

It is possible that the effect of market discipline on bank charter value may have changed with the GFC. We investigate whether, during the GFC, bank regulation and market discipline played a greater or lesser role in maintaining banks' charter value. To examine the impact of the crisis on the extent of charter value, we interact regulatory variables and market discipline variables with the crisis dummy (dummy=1 for years 2008-2011 and dummy= 0 otherwise). Regression results are reported in Table 8.

[Insert Table 8 about here]

We begin by examining whether market discipline affects charter value during the 2007/2008 crisis period. The coefficient of the interaction term between deposit growth and the crisis dummy variable is negative and statistically significant at the 1% level (*see column 1*). Similarly, we observe negative coefficient on the interaction terms *crisis* × *market discipline* (*see columns 1-5*). These findings suggest a reduced sensitivity of bank charter value to market discipline during the crisis period. This negative association indicates that depositors and creditors may anticipate government protection during the crisis period and hence have no incentive to monitor banks.

We also find that, during the crisis period, bank capital (i.e.; *crisis* × *Tier 1*) is negatively associated with charter value. Our result holds across all model specifications (*see columns 1-6*). This finding is consistent with the moral hazard effect (Allen et al., 1996) that stems from generous governmental safety nets. Prior to the GFC, Australian banks were not explicitly government-backed and taxpayers had never guaranteed bank deposits nor had they ever guaranteed institutional debt. Accordingly, these safety nets can act as a substitute for bank

capital and lead to a further reduction in bank capital levels as governmental subsidies become more generous.

Next, we analyze the importance of non-interest income, contingent liabilities, profitability, and bank intrinsic value during the crisis period. We interact each of the variables including fee income, contingent liabilities and return on average equity (*ROAE*) with the crisis dummy. The regression results are reported in Table 9.

[Insert Table 9 about here]

The coefficient of the interaction term between non-interest income and crisis dummy variable is negative and statistically significant at a 5% level in all model specifications (*see columns 1-6*). This result suggests that, in the post-crisis period, fee income tends to reduce bank charter value. We may infer from this that banks have probably reverted to more traditional business models after the crisis. In addition, we find that the coefficient of return on average equity is positive and statistically significant during the crisis period (*see columns 1-3).* Thus, banks with higher profitability tend to increase bank charter value (Keeley's measure) in the post-crisis period. One possible explanation is that our sample banks continued to report solid profits throughout the financial turmoil. A number of interrelated factors have contributed to the relatively strong performance of the Australian and Canadian banks. For instance, both banking systems have limited direct exposure to types of securities including securitization, which led to massive losses for counterparts in other countries. Further, our sample banks heavily rely on domestic loans, particularly the low-risk household sector. Therefore, better lending standards and a proactive approach to prudential supervision may have contributed to this outcome. Diagrammatic presentation of the result is reported in Appendix 2.

5. Robustness checks

We conduct several robustness checks. First, we test for possible confounding effects. This means re-estimating the models using dummy variables to adjust for some critical events that have occurred during our study period, such as the Asian financial crisis of 1997, the

Russian debt (rouble) crisis of 1998 and the internet bubble in 2000. Our main results are qualitatively insensitive to different events periods.

We re-run equations (4) and (5) including the crisis dummy and the interaction terms between bank-specific characteristics. Again, even though our main results continue to hold, we find that bank capital is negatively associated with charter value in the presence of market discipline (in particular deposit growth), suggesting some evidence of moral hazard during the Asian crisis of 1997 and the Russian debt crisis of 1998. We do not find any significant results with regard to the interaction term non-interest income × market discipline. However, we find that non-interest income appears to increase bank charter value, even in the presence of market discipline during the Asian financial crisis of 1997.

Next we re-run equations (6) and (7) including the interaction terms between crisis dummy and bank-specific characteristics. Although our main results remain unchanged, we do find some mixed evidence with regard to the interaction term *Crisis* × *market discipline*. During the Asian Crisis, and the Russian debt crisis, we find that deposit growth and charter value is positively associated. Further, our finding in relation to the interaction term, *Crisis* × *ROAE*, is negative and statistically significant at a 1% level. The coefficient on the interaction term *Crisis* × *contingent liabilities* shows mixed evidence suggesting that, during the 1997 Asian and the 1998 Russian debt crises, contingent liabilities appear to increase bank charter value.

Second, we run equations (3)–(7) for both countries separately. We find evidence that the coefficient on the interaction term *(contingent liabilities* × *crisis*) is positive and statistically significant, suggesting that contingent liabilities increase bank charter value (Keeley's measure) in the post-GFC period for Australian banks. We also find that the coefficient on the interaction term *(non-interest income* × *crisis)* is insignificant for Canadian banks indicating that our main result may be driven by Australian banks.

Third, following the work of Fiordelisi and Mare (2013), we include liquidity risk in our model, measured by liquid assets divided by deposits and short-term funding. Banks with a large

volume of liquid assets are perceived to be safer because these assets would allow the banks to meet unexpected withdrawals. We expect more liquid banks to show a higher bank charter value. Our findings demonstrate that the main results reported are not sensitive to the inclusion of liquidity risk. Finally, we apply an alternative measure of bank charter value that is market value of equity to book value of equity. The results remain unchanged from those reported in Tables 5–9 and discussed earlier in Section 4, and so are not reported separately here.[8]

6. Conclusion

The GFC has generated renewed interest into both market discipline and bank charter value. Regulators have repeatedly concentrated on strengthening Pillar 3 or market discipline for banks in controlling excessive risk-taking. Charter value has also gained the interest of the regulators in so far as it can work as a self-disciplinary tool in reducing the moral hazard problem that arises from implicit and explicit deposit insurance schemes. However, it is evident that bank charter values in Australia, Canada, Europe and USA show a declining trend and contribute to the increase in risk-taking that led to the sub-prime financial crisis. In view of its importance, and given the role that market discipline plays in the modern banking system, it is surprising how little research has dealt with the effect of market discipline on bank charter value, particularly on Australian and Canadian banks, two of the world's safest banking systems. Against this backdrop, our paper investigates the impact of market discipline on bank charter value. To this end, evidence is sought as to how this relationship is conditional on the strength of a bank's capital regulation, contingent liabilities, and non-interest income. Similarly, evidence is also sought on the effect of bank regulation and other bank characteristics during the GFC.

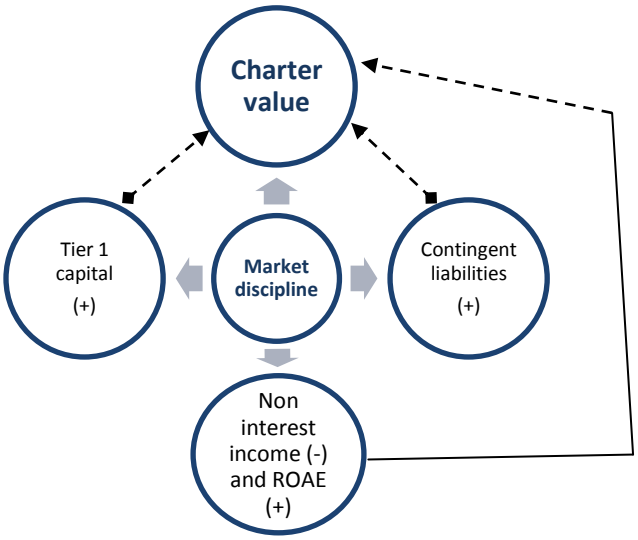
Using a sample of all publicly traded domestic banks in Australia and Canada over the 1995 to 2011 period, our results suggest that, on average, market discipline increases bank charter value, although the influence of market discipline varies depending on other bank-specific characteristics including bank capital, contingent liabilities and fee income, as well as the

[8] For the sake of brevity the results are not reported separately, however, further details on robustness tests are available upon request.

GFC. Most specifically, we find that interbank deposits impact charter value when banks have higher bank capital. Our results also suggest that depositors and creditors consider fee-based income to be risky, reducing bank charter value. Most notably, we find that sensitivity of charter value to market discipline is reduced in the post-GFC period. Finally, banks with higher profitability tend to increase bank charter value in the post-GFC period.

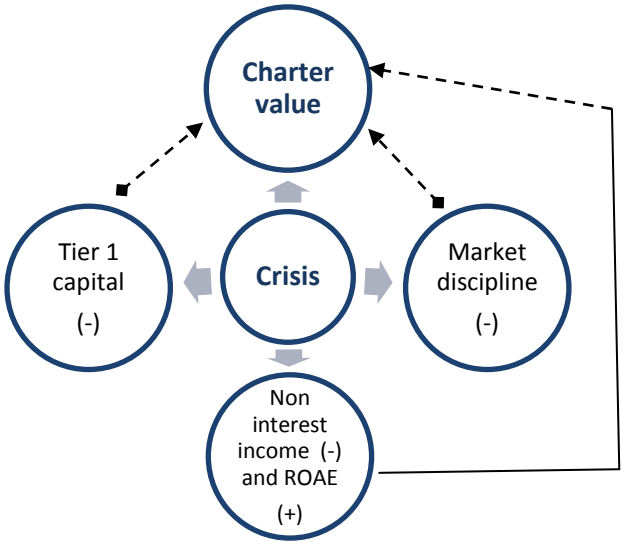
Our findings yield some policy implications for regulators and policymakers. First, the findings of this study may help regulators and policy makers to a gain a better understanding of charter value in offsetting the effects of moral hazard problem in the financial system. Second, in many jurisdictions, the banking system has become more concentrated particularly, since the onset of the GFC and hence, the disciplining power of banks' charter values may have changed, affecting banks' risk taking incentives. Thus, understanding the determinants of charter value has implications for bank safety and soundness. With regards to financial reform in the post-GFC period, our findings suggest that market discipline, bank regulation, and less volatile non-interest income, may improve banks' risk-return profile and may contribute towards a higher bank charter value.

Appendix 1 Diagrammatic presentation of moderating effects-bank-specific characteristics



The above diagram summarises the complex association that may exist among the determinants of bank charter value (see equations 4 & 5). It can be observed that in the presence of market discipline, bank capital and charter value are positively associated. A similar association is observed between contingent liabilities and charter value. In addition, it is evident that ROAE and bank charter value are positively associated, in the presence of market discipline. However, non-interest income is negatively related with charter value, when it is interacted with market discipline. Detailed explanations of the results are reported in sub-section 4.2.

Appendix 2 Diagrammatic presentation of moderating effects-GFC crisis 2007/2008



The above diagram summarises the complex association that may exist between the determinants of bank charter value and crisis dummy (see equations 6 & 7). It can be observed that during the crisis period, bank capital and charter value are negatively associated. Similar evidence is observed between market discipline and non-interest income. However, ROAE is positively associated with charter value, when it is interacted with crisis dummy. Detailed explanations of the results are reported in sub-section 4.3. The result for contingent liabilities is not reported in the diagram since it is statistically insignificant across both measures of charter value.

References

Allen, L., Rai, A., 1996. Bank charter value and capital levels: An international comparison, Journal of Economics and Business 48(3), 269-284.

Ashcraft, A. B., 2008. Does the market discipline banks? New evidence from regulatory mix, Journal of Financial Intermediation 17(4), 543-561.

Ayuso, J., Pérez, D., Saurina, J., 2004. Are capital buffers pro-cyclical? Evidence from Spanish panel data, Journal of Financial Intermediation 13(2), 249-264.

Baele, L., De Jonghe, O., Vennet, R. V., 2007. Does the stock market value bank diversification? Journal of Banking and Finance 31(7), 1999-2023.

Beck, T., Demirguc-Kunt, A., Levine, R., 2006. Bank concentration, completion and crises: first results, Journal of Banking and Finance 30(5), 1581-1603.

Beck, T., Demirguc-Kunt, A., Levine, R., 2010. Financial institutions and markets across countries and over time: The updated financial development and structure database, World Bank Economic Review 24(1), 77-92.

Blum, J., 1999. Do capital adequacy requirements reduce risks in banking? Journal of Banking and Finance 23(5), 755-771.

Blum, J., 2002. Subordinated debt, market discipline, and banks' risk taking, Journal of Banking and Finance 26(7), 1427-1441.

Boyd, J. H., De Nicoló, G., Al Jalal, A., 2006. Bank risk taking and competition revisited: new theory and new evidence, Manuscript, Carlson School of Management, University of Minnesota.

Calem, P., Rob, R., 1999. The impact of capital based regulation on bank risk taking. Journal of Financial Intermediation 8(4), 317-352.

De Jonghe, O., Vennet, R. V., 2008. Competition versus efficiency: What drives franchise values in European Banking? Journal of Banking and Finance 32(9), 1820-1835.

Demirgüç-Kunt, A., Huizinga, H., 2004. Market discipline and deposit insurance, Journal of Monetary Economics 51(2), 375-399.

Demsetz, R. S., Saidenberg, M., Strahan, P. E., 1996. Banks with something to lose: the disciplinary role of franchise value, Federal Reserve Bank of New York Economic Policy Review, 2, 1-14.

Dinger, V., Von Hagen, J., 2009. Does interbank borrowing reduce bank risk? Journal of Money, Credit and Banking 41(1-2), 491-506.

Distinguin, I., Kouassi, T., Tarazi, A., 2012. Interbank deposits and market discipline: Evidence from Central and Eastern Europe, Journal of Comparative Economics, forthcoming.

Evanoff, D. D., Wall, L. D., 2002. Subordinated debt and prompt corrective regulatory action. Federal Reserve Bank of Atlanta. Working paper no.2002-18.

Fiordelisi, F., Mare, D. S., 2013. Probability of default and efficiency in cooperative banking. Journal of International Financial Markets, Institutions and Money, 26 (1), 30-45.

Flannery, M. J., Sorescu, S. M., 1996. Evidence of bank market siscipline in subordinated debenture yields: 1983- 1991, Journal of Finance 56(4), 1347-1377.

Flannery, M. J., 2001. The faces of market discipline, Journal of Financial Services Research 20 (2-3), 107–119

Fonseca, A. R., González, F., 2010. How bank capital buffers vary across countries: The influence of cost of deposits, market power and bank regulation, Journal of Banking and Finance 34(4), 892-902.

Furlong, F. T., Kwan, S., 2006. Sources of bank charter value, Federal Reserve Bank of San Francisco.

González, F., 2005. Bank regulation and risk taking incentives: an international comparison of bank risk, Journal of Banking and Finance 29(5), 1153-1184.

Goyal, V. K., 2005. Market discipline of bank risk: Evidence from subordinated debt contracts, Journal of Financial Intermediation 14(3), 318-350.

Gropp, R., Vesala, J., Vulpes, G., 2006. Equity and bond market signals as leading indicators of bank fragility, Journal of Money, Credit and Banking 38(2), 399-428.

Haq, M., Heaney, R., 2012. Factors determining European bank risk. Journal of International Financial Markets, Institutions and Money, 22 (4), 696-718.

Herring, R. J., 2004. The subordinated debt alternative to Basel II, Journal of Financial Stability 1(2), 137-155.

Gujarati, D., 2003. Basic Econometrics, fourth ed. McGraw-Hill, New York.

Hutchison, D. E., Pennacchi, G. G., 1996. Measuring rents and interest rate risk in imperfect financial markets: The case of retail bank deposits, Journal of Financial and Quantitative Analysis 31(4), 399-417.

Keeley, M. C., 1990. Deposit insurance, risk and market power in banking, American Economic Review 80(5), 1183-1200.

Keeley, M. C., Furlong, M. T., 1990. A re-examination of the mean -variance analysis of bank capital regulation, Journal of Banking and Finance 14(1), 69-84.

Laeven, L., Levine, R., 2007. Is there a diversification discount in financial conglomerates? Journal of Financial Economics 85(2), 331-367.

Lepetit, L., Nys, E., Rous, P., Tarazi, A., 2008. Bank income structure and risk: an empirical analysis of European banks, Journal of Banking and Finance 32(8), 1452-1467.

Marcus, A. J., 1984. Deregulation and bank financial policy, Journal of Banking and Finance 8(4), 557-565.

Martínez-Peria, M. S., Schmukler, S. L., 2001. Do depositors punish banks for bad behaviour? Market discipline, deposit insurance and banking crises, Journal of Finance 56(3), 1029-1051.

Mercieca, S., Schaeck, K., Wolfe, S., 2007. Small European banks: benefits from diversification? Journal of Banking and Finance 31(7), 1975-1998.

Merton, R. C., 1977. An analytic derivation of the cost of deposit insurance and loan guarantees, Journal of Banking and Finance 1 (1), 512–520.

Myers, S., Majluf, N., 1984. Corporate financing and investment decisions when firms have information that investors do not have, Journal of Financial Economics 13(2), 187-221.

Neumark, D., Sharpe, S. A., 1992. Market structure and the nature of price rigidity: evidence from the market for consumer deposits, Quarterly Journal of Economics 107(2), 657-680.

Nier, E., Baumann, U., 2006. Market discipline, disclosure and moral hazard in banking, Journal of Financial Intermediation 15(3), 332-361.

Park, S., 1997. Risk-taking behavior of banks under regulation, Journal of Banking and Finance 21(4), 491-507.

Park, S., Peristiani, S., 1998. Market discipline by thrift depositors, Journal of Money, Credit and Banking 30(3), 347-364.

Reserve Bank of Australia, 2012, The financial stability review, www.rba.gov.au.

Rochet, J., Tirole, J., 1996. Interbank lending and systemic risk, Journal of Money, Credit and Banking 28 (4), 733-762.

Saunders, A., Wilson, B., 2001. An analysis of bank charter value and its risk constraining incentives. Journal of Financial Services Research 19 (2-3), 185-195.

Schmid, M., Walter, I., 2009. Do financial conglomerates create or destroy economic value? Journal of Financial Intermediation 18(2), 193-216.

Stiroh, K. J., 2006. New evidence on the determinants of bank risk. Journal of Financial Services Research, 30(3), 237-263.

Stiroh, K. J., Rumble, A., 2006. The dark side of diversification: The case of US financial holding companies. Journal of Banking and Finance 30(8), 2131-2161.

Tan, Y., Floros, C., 2013. Risk, capital, efficiency in Chinese banking. Journal of International Financial Markets, Institutions and Money, 26, 378-393.

Wallis, S., Beerworth, B., Carmichael, J., Harper, I., Nicholls, L., 1997. Financial system inquiry. Final report. http://fsi.treasury.gov.au/content/FinalReport.asp

Williams, B., 2012. The impact of non interest income on bank risk in Australia. 25th Australasian Banking and Finance Conference. www.ssrn.com/abstract=2130959.

Table 1 List of Sample Banks

The table shows the banks based on their size (in millions of USD). The sample consists of all publicly listed and domestic banks in Australia and Canada. The sample covers 89% of the Australian banking sector and 91% of the Canadian banking sector. **Our sample also includes St. George Bank,** although in May 2008, it entered into merger discussions with Westpac Banking Corporation. In December 2008 St. George became part of the Westpac Group, contributing almost 30% of the merged entity. In March 2010, the Westpac Group commenced operating as a single authorised deposit-taking institution (ADI) and the legal entity St.George Bank Limited was de-registered. (www.stgeorge.com.au/about-stgeorge/overview/about-us/our-history).

Bank name	Specialisation	Total assets in 2011 (in millions of USD)	Country
Royal Bank of Canada	Commercial bank	797,261.2	Canada
Toronto Dominion Bank	Commercial bank	735,946.6	Canada
National Australia Bank Limited	Commercial bank	737,242.8	Australia
Westpac Banking Corporation	Commercial bank	655,543.8	Australia
Commonwealth Bank of Australia	Commercial bank	732,557.8	Australia
Australia and New Zealand Banking Group	Commercial bank	590,975.2	Australia
Bank of Nova Scotia	Commercial bank	596,990.1	Canada
Bank of Montreal	Commercial bank	502,736.8	Canada
Canadian Imperial Bank of Commerce	Commercial bank	385,415.3	Canada
National Bank of Canada	Commercial bank	167,578.6	Canada
Macquarie Group Ltd	Bank Holding Company	159,794.1	Australia
Suncorp Group Limited	Bank Holding Company	97,892.59	Australia
Bendigo and Adelaide Bank Limited	Commercial bank	58,328.54	Australia
Bank of Queensland Limited	Commercial bank	42,656.41	Australia
Laurentian Bank of Canada	Commercial bank	29,088.28	Canada
Canadian Western Bank	Commercial bank	14,913.23	Canada

Table 2 Definition of selected variables

This table shows risk measures, bank specific and country specific variables used in analysis. The dependent variables consist of two alternate bank charter value measures. Bank–level variables include market discipline, Tier 1 ratio, contingent liabilities, return on average equity, non-interest income, and size. Macro-economic variables include bank concentration ratio, real GDP growth. Finally, a crisis dummy is incorporated.

Variables	Definition	Reference
Dependent		
Charter value (CV)	Sum of market value of equity and book value of liabilities divided by book value of total assets	Keeley (1990)
Charter value (CV1)	Demand deposits divided by total deposits	Goyal (2005)
Bank- specific variables		
Market discipline	Deposit growth(Dg)= change in deposit and short term funding to the gross domestic product (GDP) deflator	Demirgüc-Kunt et al. (2004),
	Subordinated debt(Sub)= total subordinated debt to total liabilities	Nier et al. (2006)
	Interbank deposits (Indep)=total interbank deposits to total liabilities	
Bank capital or Tier 1 ratio	Tier 1 ratio that is common equity divided by risk- adjusted assets	Berger et al. (1995)
Contingent liabilities (CL)	Total contingent liabilities divided by total liabilities	
Profitability ratio- Return on average equity (ROAE)	Net income divided by average shareholder equity	Bankscope database
Non-interest income(NIN)	Net fees and commission divided by operating income	Stiroh (2006).
Size (SZ)	Natural logarithm of total assets	
Country level variables		
Bank Concentration ratio (BNKCON)	Assets of three largest banks as a share of assets of all commercial banks.	Bank Scope database. Authors' own calculation.
Real GDP growth rate (GDP)	Gross domestic product (GDP) growth rate calculated using Real GDP.	Demirgüç-Kunt et al. (2004); www.worldbank.org
Crisis dummy (Crisis)	Dummy =1 for periods 2008-2011 and dummy =0 otherwise	

Table 3 Descriptive statistics

This table shows descriptive statistics for risk measures and bank specific characteristics. Results are for all publicly listed and domestic banks across Australia and Canada from years 1995-2011.

Variables	Mean	Maximum	Minimum	St.dev
Bank risk measures				
Charter value (CV)-Keeley's measure	1.03	1.12	0.93	0.03
Charter value (CV1)- Goyal's measure	0.54	0.99	0.02	0.40
Explanatory variables				
Market discipline - deposit growth(Dg)	0.001	0.012	-0.002	0.002
Market discipline -subordinated debt (Sub)	1.12	6.85	0.12	0.91
Market discipline –Interbank deposits (Indep)	0.04	0.33	0	0.05
Bank capital-Tier 1 ratio (Tier1)	8.88	14.70	6.10	1.81
Contingent liabilities (CL)	0.18	0.49	0.001	0.12
Return on average equity (ROAE)	14.20	30.29	1.17	4.55
Non-interest income- Net fees and commission (NIN)	0.29	0.86	0.04	0.14
Natural log of total assets (SIZE)	9.00	11.32	4.40	1.76
Bank concentration ratio (BNKCON)	53.25	76.76	37.11	8.80
Real GDP growth rate (GDP)	3.12	1.29	-2.77	5.53
Crisis dummy (Crisis)	0.25	1	0	0.43

Table 4: Correlation Analysis

The table shows the Pearson correlation matrix. Bold text indicates statistically significant at the 5% level. See Table 2 for variable definitions.

Variables	Charter value-Keeley (1990)	Charter value-Goyal (2005)	Deposit growth	Subordinated debt	Interbank deposits	Tier1 ratio	Size	Contingent liabilities	ROAE	Revenue diversification	Bank concentration ratio
Charter value	-0.06	1									
Deposit growth	**0.11**	0.09	1								
Subordinated debt	0.06	-0.03	0.09	1							
Interbank deposits	0.01	0.09	-0.08	-0.09	1						
Tier1 ratio	-0.17	0.01	-0.19	**-0.21**	**-0.20**	1					
Size	0.26	-0.09	-0.19	-0.15	-0.11	-0.17	1				
Contingent liabilities	**0.34**	**-0.30**	**-0.22**	0.09	**-0.18**	0.07	0.12	1			
Return on average equity	**0.45**	-0.14	-0.00	-0.01	**0.28**	-0.04	0.05	0.19	1		
Revenue diversification	0.11	0.08	0.07	-0.05	0.06	0.14	0.03	-0.02	0.07	1	
Bank concentration ratio	0.06	0.03	0.01	0.06	0.03	-0.11	0.16	0.02	-0.01	-0.10	1
Real GDP growth rate	0.10	0.16	0.15	0.18	0.08	**-0.39**	0.09	-0.01	0.10	0.08	-0.13

Table 5 Effect of Market Discipline on Charter Value

The dependent variable is bank reputational rent measured by Keeley's measure and Goyal's measure using equations (1) and (2). The definitions of explanatory variables are provided in table 2. Standard errors are reported in parenthesis. Superscripts*, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. Number of observations 282.

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Variables	**Keeley (1990)**	**Keeley (1990)**	**Keeley (1990)**	**Goyal (2005)**	**Goyal (2005)**	**Goyal (2005)**
Deposit growth	2.001***	-	-	0.066***	-	
	(0.667)	-	-	(0.022)	-	
Subordinated debt	-	0.085***	-	-	0.071**	-
	-	(0.021)	-	-	(0.149)	-
Interbank deposits	-	-	-0.055	-	-	0.086
	-	-	(0.040)	-	-	(0.090)
Tier 1 ratio	0.026***	0.035***	0.055***	0.015	0.030	0.043
	(0.005)	(0.008)	(0.009)	(0.013)	(0.023)	(0.035)
Size	0.377	0.254	0.297	0.487	0.405	0.457
	(0.295)	(0.215)	(0.356)	(0312)	(0.279)	(0.347)
Size^2	0.112	0.010	0.009	0.101	-0.070	-0.056
	(0.087)	(0.008)	(0.112)	(0.077)	(0.056)	(0.054)
Contingent liabilities	0.045**	0.038**	0.036**	0.028***	0.038***	0.034***
	(0.020)	(0.017)	(0.016)	(0.010)	(0.012)	(0.011)
Non-interest income	0.076***	0.089***	0.094***	0.299**	0.192**	0.255**
	(0.025)	(0.033)	(0.031)	(0.145)	(0.086)	(0.120)
ROAE	0.014***	0.020**	0.017***	0.014**	0.026**	0.019**
	(0.004)	(0.001)	(0.005)	(0.006)	(0.013)	(0.008)
Bank concentration	0.020	0.034	0.054	0.022	0.015	0.024
	(0.024)	(0.029)	(0.042)	(0.017)	(0.019)	(0.021)
Real GDP growth	-0.011**	-0.008***	-0.003***	0.015	0.038***	0.037***
	(0.005)	(0.002)	(0.001)	(0.013)	(0.014)	(0.011)
Crisis dummy	-0.065***	-0.059***	-0.068***	-0.279***	-0.363***	-0.368***
	(0.025)	(0.021)	(0.022)	(0.070)	(0.098)	(0.100)
Intercept	0.677***	0.709***	0.856***	0.432**	1.209**	1.117**
	(0.251)	(0.263)	(0.320)	(0.216)	(0.534)	(0.523)
Model fit:						
F-Test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.532	0.554	0.501	0.413	0.455	0.467

Table 6 Market Discipline and Charter Value- Intermediating Effect

dependent variable is bank reputational rent measured by Keeley's measure and Goyal's measure using equations (1) and (2). The definitions of explanatory variables are provided in table 2. Alternative measures of market discipline are considered in the analysis including, deposit growth, subordinated debt and interbank deposits. Standard errors are reported in parenthesis. Superscripts*, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. Number of observations 282.

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Variables	**Keeley (1990)**	**Keeley (1990)**	**Keeley (1990)**	**Goyal (2005)**	**Goyal (2005)**	**Goyal (2005)**
Deposit growth	0.309**	-	-	0.230	-	-
	(0.139)	-	-	(0.209)	-	-
Subordinated debt	-	0.056***	-	-	0.022**	-
	-	(0.017)	-	-	(0.010)	-
Interbank deposits	-	-	0.238	-	-	0.866
	-	-	(0.175)	-	-	(0.692)
Tier 1 ratio	0.009***	0.010**	0.006**	0.011	0.005	-0.011
	(0.003)	(0.004)	(0.002)	(0.009)	(0.004)	(0.008)
Size	0.298	0.207	0.244	0.209	0.242	0.344
	(0.242)	(0.171)	(0.187)	(0.169)	(0.167)	(0.281)
Size^2	0.015	0.034	0.030	0.022	-0.069	0.023
	(0.113)	(0.024)	(0.023)	(0.016)	(0.057)	(0.017)
Contingent liabilities	0.119**	0.232**	0.226**	0.766**	1.168**	0.655**
	(0.056)	(0.116)	(0.112)	(0.345)	(0.519)	(0.296)
Non-interest income	0.046**	0.120**	0.156**	0.200**	0.305**	0.300**
	(0.021)	(0.051)	(0.071)	(0.100)	(0.135)	(0.138)
Return on average equity	0.005***	0.003***	0.013***	0.023**	0.028**	0.023***
	(0.002)	(0.001)	(0.004)	(0.010)	(0.012)	(0.007)
Tier1 × deposit growth	-0.356	-	-	0.876	-	-
	(1.009)	-	-	(0.607)	-	-
Tier1 × subordinated debt	-	-0.245	-	-	1.207	-
	-	(0.180)	-	-	(0.862)	
Tier1 × interbank deposit	-	-	0.391**	-	-	0.522
	-	-	(0.173)	-	-	(0.401)
Contingent liabilities × deposit growth	0.987**	-	-	0.543**	-	-
	(0.418)	-	-	(0.243)	-	-
Contingent liabilities × subordinated debt	-	0.866**	-	-	0.300	-
	-	(0.400)	-	-	(0.230)	-
Contingent liabilities × interbank deposit	-	-	-0.106	-	-	0.488**
	-	-	(0.089)	-	-	(0.221)
Bank concentration	-0.001	-0.033	-0.021	0.002	0.002	0.002
	(0.002)	(0.026)	(0.018)	(0.005)	(0.003)	(0.002)
Real GDP growth	-0.010***	-0.017***	-0.005***	0.049***	0.044***	0.039***
	(0.003)	(0.005)	(0.002)	(0.017)	(0.016)	(0.013)
Crisis dummy	-0.040***	-0.037***	-0.034***	-0.343***	-0.366***	-0.359***
	(0.013)	(0.013)	(0.012)	(0.114)	(0.122)	(0.128)
Intercept	0.792***	0.830***	1.034***	1.118**	1.240**	1.598***
	(0.253)	(0.280)	(0.306)	(0.505)	(0.604)	(0.399)
Model fit:						
F-Test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.538	0.567	0.509	0.422	0.460	0.478

Table 7 Risk, Profitability, Market Discipline and Charter Value-Intermediating Effect

The dependent variable is bank reputational rent measured by Keeley's measure and Goyal's measure using equations (1) and (2). The definitions of explanatory variables are provided in Table 2. Standard errors are reported in parenthesis. Superscripts*, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. Number of observations 282.

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Variables	**Keeley (1990)**	**Keeley (1990)**	**Keeley (1990)**	**Goyal (2005)**	**Goyal (2005)**	**Goyal (2005)**
Deposit growth	0.402**	-	-	0.544**	-	-
	(0.180)	-	-	(0.251)	-	-
Subordinated debt	-	0.608***	-	-	0.208	-
	-	(0.194)	-	-	(0.198)	-
Interbank deposits	-	-	0.633	-	-	0.503**
	-	-	(0.455)	-	-	(0.229)
Tier 1 ratio	0.005***	0.006***	0.017***	0.049	0.037	0.018
	(0.002)	(0.002)	(0.005)	(0.043)	(0.029)	(0.012)
Size	0.278	0.306	0.266	0.444	0.321	0.289
	(0.193)	(0.244)	(0.212)	(0.355)	(0.243)	(0.234)
Size^2	0.007	0.012	0.043	0.109	-0.111	0.076
	(0.006)	(0.109)	(0.034)	(0.088)	(0.079)	(0.063)
Contingent liabilities	0.155**	0.198**	0.133**	0.478**	0.666**	0.435**
	(0.066)	(0.089)	(0.057)	(0.239)	(0.282)	(0.199)
Non-interest income	0.035**	0.042**	0.048**	-0.206	-0.305	-0.267
	(0.015)	(0.018)	(0.021)	(0.156)	(0.219)	(0.178)
ROAE	0.011***	0.032	0.027***	0.033**	0.019**	0.025**
	(0.003)	(0.026)	(0.007)	(0.013)	(0.008)	(0.011)
ROAE × deposit growth	0.396**	-	-	0.466**	-	-
	(0.176)	-	-	(0.207)	-	-
ROAE × subordinated debt	-	0.175**	-	-	0.043**	-
	-	(0.087)	-	-	(0.021)	-
ROAE × interbank deposit	-	-	0.145**	-	-	0.233**
	-	-	(0.065)	-	-	(0.116)
Non-interest income × deposit growth	-0.186**	-	-	0.333	-	-
	(0.084)	-	-	(0.224)	-	-
Non-interest income × subordinated debt	-	-0.765**	-	-	-0.548**	-
	-	(0.335)	-	-	(0.228)	-
Non-interest income × interbank deposit	-	-	0.199	-	-	-0.344***
	-	-	(0.132)	-	-	(0.105)
Bank concentration	-0.122	-0.109	-0.017	0.012	0.009	-0.002
	(0.101)	(0.087)	(0.013)	(0.023)	(0.060)	(0.003)
Real GDP growth	-0.009***	-0.014***	-0.110***	0.098***	0.055***	0.044**
	(0.003)	(0.004)	(0.037)	(0.026)	(0.018)	(0.019)
Crisis dummy	-0.056***	-0.044***	-0.051***	-0.355***	-0.498***	-0.356***
	(0.020)	(0.013)	(0.017)	(0.118)	(0.166)	(0.118)
Intercept	1.340***	1.453***	1.287 ***	1.366**	1.578***	1.330**
	(0.268)	(0.288)	(0.367)	(0.607)	(0.631)	(0.665)
Model fit:						
F-test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.537	0.565	0.508	0.423	0.455	0.468

Table 8 Crisis, Regulation and Charter Value- Intermediating Effect

The dependent variable is bank charter value measured by Keeley's measure and Goyal's measure using equations (1) and (2). The definitions of explanatory variables are provided in Table 2. Standard errors are reported in parenthesis. Superscripts*, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. Number of observations 282.

Variables	*(1)* **Keeley (1990)**	*(2)* **Keeley (1990)**	*(3)* **Keeley (1990)**	*(4)* **Goyal (2005)**	*(5)* **Goyal (2005)**	*(6)* **Goyal (2005)**
Deposit growth	0.799***	-	-	0.775	-	-
	(0.266)	-	-	(0.534)	-	-
Subordinated debt	-	0.222	-	-	0.187**	-
	-	(0.164)	-	-	(0.081)	-
Interbank deposits	-	-	-0.120	-	-	0.402
	-	-	(0.111)	-	-	(1.295)
Tier 1 ratio	0.009***	0.006***	0.006***	0.008	0.012	0.033
	(0.003)	(0.002)	(0.002)	(0.006)	(0.007)	(0.026)
Size	0.233	0.267	0.344	0.355	0.387	0.298
	(0.190)	(0.213)	(0.304)	(0.262)	(0.314)	(0.335)
Size^2	0.012	0.014	0.011	0.044	-0.045	0.034
	(0.008)	(0.011)	(0.009)	(0.034)	(0.036)	(0.026)
Contingent liabilities	0.026**	0.029**	0.035**	0.687***	0.777***	0.458***
	(0.014)	(0.013)	(0.017)	(0.229)	(0.258)	(0.154)
Non-interest income	0.267**	0.031**	0.051**	0.333**	0.368**	0.401**
	(0.133)	(0.015)	(0.021)	(0.156)	(0.184)	(0.178)
Return on average equity	0.008**	0.017**	0.028**	0.030**	0.029**	0.035**
	(0.004)	(0.008)	(0.019)	(0.014)	(0.013)	(0.015)
Crisis × deposit growth	-0.477**	-	-	-0.228*	-	-
	(0.213)	-	-	(0.123)	-	-
Crisis × subordinated debt	-	-1.203***	-	-	-0.800**	
	-	(0.300)	-	-	(0.370)	
Crisis × interbank deposit	-	-	-0.055*	-	-	-0.166
	-	-	(0.028)	-	-	(0.145)
Crisis × Tier1	-0.015**	-0.002**	-0.007**	-0.016**	-0.024**	-0.030**
	(0.006)	(0.001)	(0.003)	(0.007)	(0.011)	(0.013)
Bank concentration	-0.004	-0.005	-0.001	0.008	0.003	0.005
	(0.003)	(0.007)	(0.002)	(0.006)	(0.004)	(0.004)
Real GDP growth	-0.008***	-0.010***	-0.006**	0.097***	0.069***	0.055***
	(0.003)	(0.003)	(0.003)	(0.031)	(0.019)	(0.017)
Crisis dummy	-0.023**	-0.026**	-0.028**	-0.209***	-0.222***	-0.369***
	(0.011)	(0.013)	(0.013)	(0.069)	(0.064)	(0.123)
Intercept	1.456***	0.922***	1.222***	1.367***	1.499***	1.556***
	(0.364)	(0.236)	(0.305)	(0.278)	(0.299)	(0.312)
Model fit:						
F-test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.539	0.564	0.511	0.424	0.461	0.467

Table 9 Crisis, Bank-Specific Characteristics and Charter Value- Intermediating Effect

The dependent variable is bank reputational rent measured by Keeley's measure and Goyal's measure using equations (1) and (2). The definitions of explanatory variables are provided in table 2. Standard errors are reported in parenthesis. Superscripts*, **, *** indicate statistical significance at 10%, 5%, and 1% levels, respectively. Number of observations 282.

	(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*
Variables	**Keeley (1990)**	**Keeley (1990)**	**Keeley (1990)**	**Goyal (2005)**	**Goyal (2005)**	**Goyal (2005)**
Deposit growth	1.567***	-	-	0.244	-	-
	(0.591)	-	-	(0.165)	-	-
Subordinated debt	-	0.119**	-	-	1.998***	-
	-	(0.055)	-	-	(0.780)	-
Interbank deposits	-	-	-0.087	-	-	0.722
	-	-	(0.070)	-	-	(0.604)
Tier 1 ratio	0.009***	0.005***	0.019***	0.033	0.036	0.045
	(0.003)	(0.002)	(0.006)	(0.027)	(0.025)	(0.033)
Size	0.177	0.366	0.299	0.543	0.423	0.501
	(0.130)	(0.257)	(0.257)	(0.369)	(0.276)	(0.487)
Size^2	0.022	0.014	0.143	0.066	-0.059	0.111
	(0.018)	(0.012)	(0.116)	(0.050)	(0.047)	(0.082)
Contingent liabilities	0.025**	0.029**	0.025**	0.876***	0.776***	0.823***
	(0.012)	(0.014)	(0.011)	(0.342)	(0.224)	(0.272)
Non-interest income	0.030**	0.047**	0.054**	-0.143	-0.208	-0.122
	(0.014)	(0.020)	(0.022)	(0.119)	(0.152)	(0.907)
Return on average equity	0.006***	0.011***	0.018***	0.188**	0.168**	0.233**
	(0.002)	(0.002)	(0.006)	(0.085)	(0.074)	(0.103)
Crisis × contingent liabilities	0.011	0.016	0.023	0.333	0.422	0.398
	(0.022)	(0.018)	(0.015)	(0.252)	(0.439)	(0.288)
Crisis × non-interest income	-0.102**	-0.128**	-0.199**	-0.634**	-0.553**	-0.666**
	(0.047)	(0.057)	(0.088)	(0.268)	(0.251)	(0.289)
Crisis × ROAE	0.009***	0.015***	0.017***	0.015	0.028	0.030
	(0.002)	(0.005)	(0.005)	(0.012)	(0.023)	(0.025)
Bank concentration	-0.001	-0.011	-0.005	0.021	0.024	0.019
	(0.001)	(0.037)	(0.004)	(0.015)	(0.019)	(0.023)
Real GDP growth	-0.013***	-0.024***	-0.012***	0.039***	0.045***	0.052***
	(0.004)	(0.008)	(0.004)	(0.010)	(0.011)	(0.015)
Crisis dummy	-0.112	-0.023	-0.033	-0.400***	-0.389***	-0.455***
	(0.086)	(0.017)	(0.023)	(0.133)	(0.077)	(0.095)
Intercept	0.933**	1.665***	1.234**	1.743**	1.454**	1.884**
	(0.433)	(0.555)	(0.546)	(0.780)	(0.691)	(0.819)
Model fit:						
F-test (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
R-squared	0.539	0.560	0.507	0.423	0.462	0.469